DOCUMENT RESUME

ED 186 374 SP 015 808

AUTHOR	Borich, Gary D.
TITLE	Implications for Developing Teacher Competencies from Process-Product Research.
PUB DATE	79
NOTE	25p.
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Academic Achievement: *Classroom Techniques; *Interaction Process Analysis; *Research Methodology; Responses: Student Teacher Relationship: Teacher Attitudes: *Teacher Behavior: Teacher Characteristics: Teacher Education: Teacher Effectiveness: Teacher Evaluation

ABSTRACT

Five studies identifying the relationships between teacher behavior and pupil achievement are reviewed. The purpose of the review is to report the most practical implications for teacher education. The behaviors listed in these studies represent only those teacher processes, skills, or performances that have exhibited statistically significant relationships to pupil outcomes in mathematics or reading. The research methodology used in each study is reviewed and results are analyzed. Implications for teacher education programs are discussed. (JD)

Implications for Developing Teacher Competencies from Process-Product Research

Gary D. Borich

The University of Texas at Austin

The word "competency" is an imprecise term, even to those who use it frequently. While it appears in the training literature repeatedly, its use and interpretation vary widely, and the list of synonyms for it is long. For example, terms such as "teacher behavior," "teacher variable," " teacher performance," and "teacher skill," have at one time or another and in one article or another been used interchangeably with the term "teacher competency." Perhaps because its origin may have been more political than substantive, the term has yet to take on a single and universally recognized meaning. One purpose of this paper will be to suggest a more restrictive definition for the term "competency" and to point to some research findings which could be used in support of this definition.

In the most general sense, a "competency" has come to stand for a skill, behavior, or performance expected of a trainee at the completion of training. While the term implies a criterion performance level--a cut-off point dividing those who have attained the competency from those who have not attained the competency--no such designation is included in the definition of a competency, as would be in a well-stated behavioral objective. The absence of expected proficiency levels in competency statements obscures the validity of competencies: How are we to know the level of execution at which the competency is most effective in producing desired pupil outcomes? The term "competency," while connoting an acceptable performance, in practice offers no more specificity of process or performance than the words "behavior," "variable," or "skill." It was this observation that led the author to pose distinct and non-overlapping definitions for the terms "behavior," "variable," and

competency" (Borich, 1977). According to these definitions, the three concepts are viewed as progressively more specific, variables being derived from behaviors and competencies being derived from variables--with competencies defined in terms of proficiency levels validated against pupil outcomes.

This conceptualization makes the term "competency" synonymous with "validated competency." That is, the word "competency" is reserved for the special case in which process-product studies have confirmed the relationship between a teaching behavior and pupil outcome. Given such process-product findings, we can estimate the optimal proficiency level or range of levels for the behavior in question.

These definitions provide a framework from which to view the contribution of individual teacher research and evaluation studies to the overall objectives of teacher education and training. Using this framework, the author found that research on teaching, broadly classified, is distributed in the shape of a diamond, at the apex of which are the relatively few studies that have evaluated teacher behavior for the purpose of establishing proficiency levels, at the center the majority, which have evaluated teacher behavior to establish relationships between teacher process and pupil product variables, and at the bottom, the relatively few studies that have evaluated teacher behavior in order to determine the behaviors attained by program graduates.

Major Process-Product Studies

Most relevant to the objectives of this paper are studies that have attempted to identify relationships between teacher behavior and pupil outcome--those at the center of the diamond. The findings from these studies, usually in the form of process-product correlations, comprise the core of our

research base for deriving competency statements. Together with conceptual models of effective teaching, the professional experience of teacher trainers and the values and goals of the training institution, these findings provide justification for the teacher behaviors that are taught.

Medley (1977) has provided teacher educators the service of reviewing 289 process-product studies and reporting in a systematic format the results of 14 which met reasonably stringent criteria of generalizability, reliability, importance and practically. The present review elaborates on five process-product studies among those most heavily cited by Medley and summarizes for teacher trainers and program developers the kinds of competency implications they contain. The intent is not to be exhaustive in presenting these five studies but to provide competency implications that are illustrative of those that can be derived from the larger body of process-product studies of which these five studies are representative and for which proficiency levels could be estimated.

The present review differs from other reviews (Rosenshine, 1971, 1975; Duncan and Biddle, 1974; Medley, 1977) in the level of abstraction at which findings across studies are compared. While summary tables of process-product correlations are predominant in these earlier reviews, the present review utilizes as "raw data" the competency implications either expressed or implied by the investigators of these studies. Thus, the purpose of this review is not to report process-product correlations but to report the most parsimonious and practical implications for the training of teachers that can be derived from them. The results to be reported are much like the cumulative and summary judgments rendered by a classroom observer using a high-inference rating scale, many pieces of information are integrated in making the final judgment.

The intervening step which links process-product correlations to competency implications is as much dependent on human insight and judgment as it is on statistical and research accumen. The process is not unlike naming factors from a factor analysis: knowledge of the phenomenon one is measuring goes a long way in helping make sense out of the data. The researcher who provides this link must possess both the technical skills to know when findings are reliable and statistically significant and the insight and judgment to know when they are practically meaningful. Significant but contradictory process-product correlations across related variables may be of little or no value in deriving competency implications, while a converging pattern of relationships, whether significant or not, may be of great value. Because insight and judgment play such an important role at higher levels of abstraction, any single review of process-product studies is likely to be more illustrative than definitive.

A second and equally important reason for deriving competency implications from process-product studies is to scrutinize the findings of these studies for their practical significance. Raw correlations and the tables which present them can highlight the statistical significance of a finding but also mask its practical significance by avoiding the natural language into which all findings must ultimately be translated. If all process-product findings were reported in terms of their competency implications as well as statistical significance, the importance of some findings might be appropriately deemphasized for lack of policy relevant and program related implications. For example in the lists of competency implications to follow, readers will find some that translate into guidelines for the design of training materials and the conduct of training programs, others that are ambiguous as to how they might be implemented, and

still others that are too trivial or obvious to have practical significance. Yet, all such "competency" statements were derived from statistically significant process-product correlations.

Each of the studies chosen for this review are described below followed by their respective competency implications. Though heavily funded and frequently cited in the literature (e.g. Rosenshine, 1975; Medley, 1977), these studies are not the only ones from which competency statements could be derived. For other reviews of process-product studies see also Rosenshine (1971), Dunkin and Biddle (1974) and Medley (1977). The present studies were selected to be illustrative of the type of studies from which competency statements could be derived and no inference should be made that this selection is exhaustive, although it is believed to be representative.

In the lists of competency implications to follow teacher behaviors are listed within studies in order to convey the number and type of outcomes produced by each research effort--although some findings run across subsets of studies. The behaviors listed represent only those teacher processes, skills, or performances that have exhibited statistically significant relationships to pupil outcomes in mathematics and/or reading. Many other behaviors--often two, three, or even four times the number listed--were studied and found unrelated to pupil achievement. It is important to note also that these competency implications were derived from correlational studies, and thus these variables may be only associated with, not causal to, pupil learning. The experimental manipulation of teacher behavior and random assignment of pupils to teachers are two methodological techniques required to establish the cause and effect nature of these implications.

To illustrate the translation of process-product relationships into competency statements, to the left of each composite teacher variable is listed its most specific implication for preparing a competency statement and establishing a proficiency level. While these competencies were derived from interpretations, expressed or implied, made by the researchers in their respective papers, this author takes sole responsibility for their accuracy in embodying the spirit of the researchers' conclusions. While the results of some of these studies have appeared in several forms, reference is made here to the most comprehensive version available. Summary versions in which competency implications have appeared may be found in Borich (1977, Chapter 6). Two tables are provided to assist the reader in comparing studies. Table 1 summarizes the general methodological characteristics of the studies, while Table 2 summarizes the conclusions across studies, indicating consistent and inconsistent findings.

1. Brophy, J., and Evertson, C. "Process-Product Correlations in the Texas Teacher Effectiveness Study: Final Report (RES.REP. 74-4)." Austin, Texas, Research and Development Center for Teacher Education, 1974.

   Brophy, J., and Evertson, C. Learning from Teaching: A Developmental Perspective. Boston: Allyn and Bacon, Inc., 1976.

This study was a 2-year effort designed to discover teacher characteristics associated with the teacher's success in producing student gains on the Metropolitan Achievement Tests (MAT). Scores on each of five MAT subtests were obtained for 3 consecutive years for the pupils of 165 2nd- and 3rd-grade teachers in an urban school system. Each student's raw mean score (grade level equivalent) was converted to a residual gain score by an adjustment that took into account the child's pretest scores.[1] These residual or adjusted gain scores were categorized by class, and a mean residual gain score on each subtest was computed

[1]A residual gain score for a particular student represents that student's posttest performance unaffected by his level of performance on the pretest. A residual gain score for a particular teacher represents his pupils' level of achievement over (positive residual) or under (negative residual) the average gain for all classrooms.

for each of 165 teachers for each of the 3 years studied. The authors then selected from the 165 a subsample of teachers who were notably consistent in producing achievement gains over the years, and across subtests and pupil sex. In the final stage, they observed subsamples of 17 2nd-grade and 14 3rd-grade teachers the first year and 15 2nd-grade and 13 3rd-grade teachers the second year, using both high- and low-inference measures based upon the Brophy-Good Dyadic Interaction System (1970). Significant process-product relationships were replicated across both years of the study.

BROPHY-EVERTSON RESULTS

General Findings

Variables	Competency Implications
1) Classroom Management	(Teacher should have the ability to)* keep pupils actively engaged.
2) Rules	Establish flexible rules sufficient to keep order, and change them when necessary.
3) Punishment	Use mild, non-physical forms of punishment.
4) Role Definition	Take personal responsibility for student learning and have high expectations.
5) Individualization	Match the difficulty of the lesson with the ability of the pupils, and vary the difficulty as necessary.
6) Group Lessons	Call on children systematically rather than randomly. Give students opportunity to practice newly learned concepts and to get feedback.

*This phase is implied throughout the remainder of the list. Teacher behaviors specific to a particular type of student and/or dependent variable are indicated by variable headings or the wording of the competency implication.

7) Teacher Feedback	Give credit for partially correct answers. Accept questions in the form they are asked. Give feedback.
8) Student Initiation	Encourage students to ask questions.

Findings for Low-SES Pupils

9) Teacher Affect	Be warm and encouraging, let students know that help is available.
10) Student Responses	Elicit response from the student each time a question is asked, before moving to the next student or question.
11) Over Teaching/Over Learning	Present material in small chunks, at a slow pace, with opportunity for practice.
12) Classroom Interaction	Stress factual knowledge. Monitor student progress. Minimize interruptions by maintaining smooth flow from one activity to another. Help student who needs help immediately.
13) Individualization	Supplement standard curriculum with specialized material to meet the needs of individual students.

Findings for High-SES Pupils

14) Praise and Criticism	Correct poor answers when student fails to perform.
15) Individualization	Ask difficult questions. Follow prescribed curriculum. Assign homework.
16) Classroom Management	Be flexible. Let students initiate teacher-student interaction. Encourage students to reason out correct answer.
17) Verbal Activities	Engage students in verbal questions and answers.

2. Stallings, J., and Koskowitz, D. "Follow-Through Classroom Observation Evaluation, 1972-1973." Menlo Park, California: Stanford Research Institute, 1974.

This study was a multi-year effort that examined four 1st-grade and four 3rd-grade classrooms in 26 cities. These classrooms represented five projects in six Follow-Through programs and six projects in a seventh educational program. The goal of Follow-Through was to examine the differential effectiveness of instructional programs based on divergent theories of education and development that had implications for teacher training and evaluation. One 1st-grade and one 3rd-grade non-Follow-Through classroom were selected for comparison at each project site. Using a multifaceted classroom observation instrument, Stallings and Kaskowitz gathered data about classroom environment and teacher process--specifically about seating patterns, the presence and use of equipment and materials, grouping of children, staff, and activities in the classroom, the role of the person who is the focus of classroom interaction, and the type and quality of that interaction. Pupil behavior relating to independence, task persistence, cooperation and questioning was assessed on the same classroom observation system. Reading and math skills were measured on the Metropolitan Achievement Tests, and problem solving and pupil responsibility were assessed on additional paper and pencil measures.

STALLINGS-KASKOWITZ RESULTS

Variables	Competency Implication
1) Length of School Day	Maximize instructional time.
2) Systematic Instructional Patterns	Use this instructional model: (a) provide information, (b) ask questions about the information, (c) allow child to respond, (d) give feedback, and (g) guide pupil to correct response.

3) Discussion	Encourage class discussion of material during mathematics instruction.
4) Praise	Encourage and praise pupil with low entering ability during mathematics instruction.
5) Textbooks and Programmed Workbooks	Use textbooks and programmed workbooks during mathematics instruction and foster task persistence.
6) Flexible Classroom	Use wide variety of materials and audio-visual aids. Be flexible in allowing pupils to select groups and seats. Encourage pupils to take responsibility for their success.
7) Expository Materials	Use variety of exploratory materials to foster pupil cooperation.
8) Question Asking	Respond to child questions and engage in conversations with child.

3. Good, T.L., and Grouws, D. A. "Process-Product Relationships in Fourth Grade Mathematics Classes." Columbia, Missouri: College of Education, University of Missouri, 1975.

This study, in many ways similar to the Brophy-Evertson research, examined relationships between teacher process and pupil mathematics achievement in 4th-grade classrooms. Following the method employed by Brophy and Evertson, Good and Grouws selected a subset of 41 teachers from a total sample of 130 whose students had demonstrated gains on the Iowa Tests of Basic Skills for 2 consecutive years. Teacher behavior was measured on two instruments: the low-inference Brophy-Good Dyadic Interaction System, which codes approximately 164 discrete teacher behaviors, and a high-inference scale on which 8 variables (organization, alerting, accountability, classroom climate, thrust of homework, student attention, clarity, and enthusiasm) were rated in a Likert-style format. In analyzing their data, Good and Grouws performed a test of significance between differences in the behavior of the top and bottom nine and

the top and bottom three teachers. These relative rankings were established by determining the mean residual pupil gain score for each teacher for two consecutive years. Thus, the more and less effective teachers were those whose pupils had the highest positive residual gain scores (top) and highest negative residual gain scores (bottom) over two consecutive years on the Iowa Tests of Basic Skills total math subscale.

GOOD-GROUWS RESULTS*

Variables	Competency Implication
1) Whole Class Instruction	Maximize time class is taught as a single unit.
2) Classroom Climate	Reduce classroom tension and anxiety. Engender relaxed, non-evaluative classroom atmosphere.
3) Accountability	Establish pupil standards and expect specific pupil accomplishments.
4) Feedback	Give students as much information as needed, especially through process feedback.
5) Questioning	Ask unambiguous questions that pupil can answer completely or not at all.
6) Praise	Limit praise, especially when performance is poor and expectations low.
7) Teacher Initiated Contact	Avoid approaching specific pupils for the purpose of criticizing or blaming.
8) Pupil initiated Contact	Encourage pupils to approach teacher individually or work-related matters.
9) Classroom Discipline and Management	Maintain classroom free of major behavioral disorders.

*The results reported are those that were consistent across separate analyses of data obtained from the top and bottom nine teachers and the top and bottom three teachers.

4. Soar, R. S. "An Integrative Approach to Classroom Learning." Philadelphia, Temple University, 1966. ERIC Document Reproduction Service (ED 033 749).

Soar, R. S., and Soar, R. N. "An Empirical Analysis of Selected Follow-Through Programs: An Example of a Process Approach to Evaluation." in I. J. Gordon (Ed.), Early Childhood Education. Chicago: National Society for the Study of Evaluation, 1972.

These two citations actually represent a series of four studies. The first was conducted in four elementary schools, grades 3 through 6. The behavior of 55 teachers was recorded on three observation systems: The Flanders Interaction Analysis System; a second instrument specifically designed to cover areas outside the Flanders exclusive focus on verbal behavior; and a third measure for recording affect--positive and negative, teacher and pupil, verbal and nonverbal. Pupil measures were obtained on the vocabulary, reading, and arithmetic computation subtests of the Iowa Tests of Basic Skills. These were supplemented with a number of personality, attitude, and creativity measures.

The second study was conducted using the Follow-Through data described in the Stallings and Kaskowitz study. Its primary objective was the identification of dimensions of teacher behavior which were related to pupil gain across programs. Eight teachers from each of seven experimental programs were observed, along with two comparison teachers from each program site.

In the third and fourth studies, a 1st-grade sample of 22 classrooms and a 5th-grade sample of 59 classrooms were employed. The observation measures used on these samples, and on the Follow-Through sample above, included a revision of the instrument developed for the first study, in order to code the teacher's classroom management behavior and the pupil's response to that behavior. Another observation instrument employed in the last three studies recorded pupil interaction as comprehensively as the Flanders coded teacher behavior, and a third measured cognitive behavior exclusively.

Like the other studies described, these four focused primarily on the reading and mathematics achievement of pupils and employed residual gain scores corrected for pretest achievement.

SOAR-SOAR RESULTS

Variables	Competency Implication
1) Direction and Control of Learning	Provide moderate direction and control of pupil learning, avoiding extremes.
2) Structuring	Vary amount of structure; reduce structure for more complex content (high cognitive objectives); and increase structure for more elementary content (low cognitive objectives).
3) Teacher-Pupil Interaction	Vary level of teacher-pupil interaction, depending on pupil's ability to cope successfully with the activity at hand.
4) Teacher Affect	Vary level of affect: Increase positive affect for low-SES pupils, reduce positive affect for high-SES pupils.

5. McDonald, F. J., Elias, P., Stone, M., Wheeler, P., Lambert, N., Calfee, R., Sandoval, J., Ekstrom, R., and Lockheed, M. "Final Report on Phase II Beginning Teacher Evaluation Study." California Commission on Teacher Preparation and Licensing, Sacramento, California. Princeton: Educational Testing Service, 1975.

This study was the initial phase of a long-term investigation of teacher effectiveness. Pupil performance in reading and mathematics was assessed at two points in time and the teachers' classroom behavior during the intervening period was measured and then related to differential pupil achievement. The California Achievement Test was used to measure pupil cognitive performance, while various other instruments were used to assess pupil attitudes, cognitive

style, expectations, and classroom behavior. The performance of 44 2nd-grade and 53 5th-grade teachers with 3 or more years of experience was recorded during reading and mathematics instruction on an observational coding system especially developed for this study. The system included categories for the teacher's introductory remarks, explanation, questions, reactions to pupil behavior, and feedback to pupil learning. Two global rating scales were used to measure teacher feedback, directiveness, management, and classroom control as well as other general behaviors such as motivation, warmth, and honesty. As in the other studies described, teacher data were related to the adjusted posttest achievement scores of pupils in order to identify more effective and less effective teaching behaviors.

MCDONALD ET AL. RESULTS

Variables	Competency Implications
1) Instruction Time	Maximize direct instruction time during reading by using group procedures, while maintaining a high level of interaction with individual pupils (2nd).* Increase individual monitoring and reduce group work during mathematics instruction (2nd).
2) Instructional Content	Maximize coverage of instructional content per unit of time during mathematics instruction (2nd, 5th).
3) Instructional Activity	Devote considerable time to discussing, explaining, questioning, and stimulating cognitive processes during reading instruction (5th).
4) Instructional Organization	Maximize group work during mathematics instruction (5th). Minimize independent work during mathematics instruction, especially that which may interfere with on-task behavior (5th).

*The codes (2nd) and (5th) refer to the grade level at which these implications are most applicable.

5) Interactive Technique

Employ specific cues and questions that require the student to attempt a response during reading instruction (2nd).
Employ thought-provoking questions during reading instruction (5th).

General Findings

The above studies--and, in fact, most process-product investigations from which competency statements are derived--share the following characteristics:

1. They are confined to early and mid elementary grades and primarily to reading and mathematics instruction.

2. They focus on pupil outcome as measured by nationally standardized tests of pupil achievement.

3. They emphasize teacher behaviors measurable on low-inference classroom observation systems.

4. They have produced qualified findings within SES level, grade, and subject matter.

5. They have been conducted with experienced teachers.

In addition, these studies share many (but not all) findings. Congruent and incongruent results are summarized below and in Table 2.

1. Teacher Questioning. The value of a systematic, patterned questioning strategy that focuses on individual pupil needs and understanding was confirmed in both studies that investigated this variable.

2. Whole Class Instruction. The value of teaching the class as a unit was confirmed in two out of three studies.

3. Instructional Materials. The value of using specialized materials, including textbooks and workbooks, was confirmed in two out of three studies.

4. Praise. The value of praise was unclear, though it appeared to be related to pupil SES, with lower-SES pupils profiting more from this teacher behavior than higher-SES pupils.

5. Flexibility. The value of flexible rules was confirmed in both studies that investigated this variable.

6. Control and Structuring. The value of controlling pupil responses and structuring pupil behavior was confounded by pupil SES and the cognitive objectives of the teacher. Lower-SES pupils benefit from tighter control, and higher cognitive objectives are more likely to be achieved in a less structured situation.

7. Interaction. The value of teacher-pupil interaction may depend on the situation and the kind of interaction. It appears to have a positive effect during group lessons and a negative effect most other times.

8. Teacher Affect. The value of high teacher affect with low-SES pupils and low teacher affect with high-SES pupils was confirmed in both studies that investigated this variable.

9. Pupil Engagement. The value of engaging pupils in on-task behavior (and keeping them engaged) was confirmed in two out of three studies, and may have been situation-specific in the third.

10. Student-Initiated Questions. The value of student-initiated questions was confirmed in both studies that investigated this variable.

11. Clarity. The value of teacher clarity was unapparent, and probably content- and situation-specific.

12. Attention Getting. The value of getting and keeping pupil attention was confirmed in both studies that investigated this variable.

13. Feedback. The value of feedback seems to have been related to the aspect of pupil performance (substance or form) to which the teacher was responding. Feedback on substance had positive impact on pupil achievement, while the effect of process feedback depended on its context and type.

Final Thoughts

Given the attention which normally accompanies process-product views some final observations are in order concerning the review process itself.

(1) Most reviews of process-product studies have been conducted by a limited number of reviewers, emphasizing the results of a relatively small number of studies. Generally, these studies have been those which have been supported by external funds and conducted by principal investigators who have

achieved a reputation for exemplary work. However, these characteristics in themselves, are no guarantee of the quality and usefulness of a particular study. Theoretical formulation, methodology, variable selection, and professional judgment can make a small experimental study conducted by an obscure but competent researcher more useful than a large scale process-product study conducted by a well known researcher. Hence, there may be a need in subsequent reviews to devote additional effort to finding and interpreting important but less salient studies conducted by lesser known researchers.

(2) Any review that is less than trivial must necessarily involve abstraction and inference. Thus, there is always the danger that personal and professional biases will enter into the judgment of the reviewer. As Kuhn (1970) has made us painfully aware "an apparently arbitrary element, compounded of personal and historial accident, is always a formative ingredient of the beliefs espoused by a given scientific community (and scientist) at a given time....among those legitimate possibilities, the particular conclusions he does arrive at are probably determined by this prior experience in other fields, by the accidents of his investigation, and by his own individual makeup" (p. 4). There are, however, safeguards which protect against the detrimental effects of personal and professional bias - the most powerful being that of replication. Hence, there may be a need for more reviewers as well as reviews, even when the same studies are covered.

(3) For the most part, existing reviews of process-product studies have been written by and for the research community. One objective of these reviews has been to provide the reader with charts and tables which convey large amounts of data in an at-a-glance format. While data displays are fundamental to the review process, this style of reporting may not be as useful to the practitioner as it is to the researcher. It is conceivable that the practitioner

uses criteria different than the researcher to interpret and evaluate "data". These criteria may include but need not be limited to the obviousness, triviality and contextual representativeness of the findings, characteristics which are often masked by the statistical format of charts and tables. Hence, there may be a need for subsequent reviews to express findings in multiple formats: process-product correlations as well as natural language expressions indicating what the finding means for a particular teacher.

(4) The distinction between a finding that is statistically significant and one that is practically meaningful may lie with different uses the researcher and practitioner have for the review data. The researcher looks for patterns in the data - consistencies and inconsistencies - with the aim of discovering new relationships and new insights. The practitioner looks for direct behavioral applications to the classroom, an agenda for action, things to do and things to avoid, if only to confirm existing beliefs and practices. The natural language translation of process-product correlations is one way of allowing the practitioner to judge for himself or herself the practical meaning of process-product results. It is here that the practitioner may be of special service by identifying those findings which reached statistical significance but have little practical value and those findings which failed to reach statistical significance but have great practical value. It is important to note that the present attempt to translate process-product findings into natural language expressions has resulted in what appears to be many intuitively obvious and some trivial implications for classroom behavior. This may suggest that process-product studies may be at least as useful for confirming commonly held intuitions about classroom processes as for discovering new relationships and insights. The importance of these two purposes for process-product studies has not always

been appreciated.

(5) Lastly, there is the intemperate question of whether or not the process-product paradigm has outlived its usefulness. Clearly, its relative ease of implementation compared to experimental studies, its potential for contextual validity, its hypothesis generating value, its large amount of interpretive data, and the simplicity of its methodology are all in its favor. However, the way in which the process-product paradigm is used in teacher behavior research is unique in the history and philosophy of science. Process-product studies in other fields, or analogs of them, are employed mainly as hypothesis generating devices when theoretical formulations are not possible due to the absence of knowledge about a given phenomenon. In teacher behavior research, process-product studies are often used to tentatively produce findings prior to the time in which a full scale experimental study can be mounted, few of which, it seems, ever materialize. Hence, process-product findings tend to be conclusion oriented, as can be noted in the present review as well as those of Medley, Rosenshine and Duncan & Biddle. Our use of the process-product paradigm is somewhat at odds with the major strength of this approach, which is to build theory. Reviews of process-product studies do not characteristically build theory but focus instead on conclusions which can be supported by these studies. Theory building seems a rather forelorn enterprise among process-product researchers and its presence in future reviews is needed.

It is interesting to note a major difference between the experimental and correlational researcher with regards to the use of theory. Traditionally, the experimentalist dislikes surprises, anomolies or unexpected findings. This is because such occurences necessarily must reflect embarrassing omissions or inadequacies in the theory upon which the study was based. In contrast, it is remarkable how well "surprises" in the data are handled by process-product

researchers. Even counter-intuitive findings eventually seem to be accompanied with some type of plausible interpretation consistent with other findings in the study. This is because every finding is seen primarily for its immediate usefulness and only secondarily for its role in theory development. Atheoretical studies allow this amelioration of contradictions while theoretically based studies do not.

Finally, there is the question of whether inconsistencies in the findings of process-product studies (Rosenshine, 1975 p. 2, Medley, 1977, p. 12, Borich, 1977, p. 77-78, Shavelson and Atwood, 1977, pp. 366-67, 1977) can ever be resolved with the process-product paradigm. The odds are that they cannot for two reasons. The first is that one implicit purpose of the process-product paradigm is to bring to the foreground just such inconsistencies. These inconsistencies provide the "stuff" from which theories are built. Second, it seems no more likely in the future than in the past that process-product studies will be sufficiently matched in sample, context, variables, and instrumentation to unequivocally resolve contradictory findings. Thus, process-product reviews might take a different tact. While tentative conclusions from process-product studies are important, it seems that the development of theoretical formulations which can account for the conclusions they report is of even greater importance. It is on this task that subsequent reviews should focus.

Table 1

Some Contextural Characteristics of Five Major Process-Product Studies

Researchers	Grades	Content	Sample size	Sample selection method	Criterion measures*
Brophy-Evertson	2nd, 3rd	Reading, math	1st year: 17 (2nd); 14 (3rd) 2nd year: 15 (2nd); 13 (3rd)	Self-selected + consistency in producing learning gains over a four-year period	Residualized gain, MAT
Soar	1st, 3rd, 4th, 5th, 6th	Reading, math	Study 1: 55 (3rd-6th) Study 2: 20 (1st) Studies 3 & 4: 22 (1st); 59 (5th)	Self-selected	Residualized gain, ITBS, MRT, MAT
Stallings-Kaskowitz	1st, 3rd	Reading, math	105 (1st) 58 (3rd)	Self-selected	Raven's MAT with WRAT as covariable, IAR, SRI observation instrument
Good-Grouws	4th	Math	41	Self-selected + top and bottom on residualized gains	Residualized gain, ITBS
McDonald et al.	2nd, 5th	Reading, math	44 (2nd) 53 (5th)	Self-selected + three years experience	CAT as coveriable

*Key to criterion measures: MAT = Metropolitan Achievement Test; ITBS = Iowa Test of Basic Skills; MRT = Metropolitan Readiness Test; WRAT = Wide Range Achievement Test; IAR = Intellectual Achievement Responsibility Scale; SRI = Stanford Research Institute; CAT = California Achievement Test.

Table 2

Selected Congruent and Discrepant Findings for Five Research Studies

Brophy-Evertson	Soar	Stallings-Kaskowitz	Good-Grouws[1]	McDonald et al.
Teacher responds to each question + L* Making sure student understands + L		Provides information/ asks question (systematic instructional pattern)+		
		Use of small groups +	Teaching whole class +	Teaching whole class +
Specialized materials + L		Use of textbooks and workbooks +		Variety of instructional materials -
Praise after student answers opinion questions + L Student initiated praise - L		Praise**	Praise -	
Flexibility of rules +		Flexible classrooms +		
Controlling student responses + L, - H Teacher structuring and feedback - L	Direction and control of learning ∩ *** Unobtrusive structuring behavior - L, + H			Time organizing instructional activity -
Interacting with individuals during group lessons +	Teacher-pupil interaction at high cognitive level -		Teacher afforded contact with students -	
Teacher affect + L, o H	Teacher affect + L, -H			
Keeping students actively engaged +				Maintaining task involvement -
			Time teaching whole class +	Content covered +
Student initiated questions +			Student initiated interaction +	
Clarity o			Clarity +	
Getting groups' attention +			Alerting behavior +	
Giving student correct answer + Responding to substance rather than form + Failure to give feedback -			Process feedback -	

Note: + indicates positive relationship to pupil achievement, - indicates negative relationship, o indicates no relationship.

*L indicates finding for low-SES pupils only, H indicates finding for high-SES pupils only.

** The effect of praise on achievement in math in first grade was variable: in classrooms where children had relatively low entering ability, pupils profited more from a high rate of praise than they did in classrooms where students had higher entering ability.

*** Soar's inverted U, indicating a curvilinear relationship between direction and control or learning and pupil achievement.

[1] The results reported are those that were consistent across separate analyses of data obtained from the top and bottom nine teachers <u>or</u> the top and bottom three teachers.

References

Borich, G. The appraisal of teaching: Concepts and process. Reading, Mass.: Addison-Wesley Publishing Company, 1977.

Brophy, J., & Evertson, C. Process-product correlations in the Texas teacher effectiveness study: Final report (RES.RESP. 74-4). Austin, Texas: Research and Development Center for Teacher Education, 1974.

Brophy, J., & Evertson, C. Learning from teaching: A developmental perspective. Boston: Allyn and Bacon, Inc., 1976.

Brophy, J., & Good, T. The Brophy-Good dyadic interaction system. In A. Simon and E. Boyer (Eds.), Mirrors for behavior: An anthology of observation instruments continued, 1970 supplement (Vol. A). Philadelphia: Research for Better Schools, Inc., 1970.

Dunkin, M., & Biddle, B. The study of teaching. New York: Holt, Rinehart and Winston, Inc., 1974.

Good, T. & Grouws, D. Process-product relationships in fourth grade mathematics classes. Columbia, Missouri: College of Education, University of Missouri, 1975.

Kuhn, T., The structure of scientific revolutions. Chicago: University of Chicago Press, 1970.

Medley, D. M. Teacher competence and teacher effectiveness: A review of process-product research. Washington, D. C.: American Association of Colleges of Teacher Education, 1977.

McDonald, F., Elias, P., Stone, M., Wheeler, P., Lambert, N., Calfee, R., Sandoval, J., Ekstrom, R., & Lockheed, M. Final report on Phase II beginning teacher evaluation study. California commission on Teacher Preparation and Licensing, Sacramento, California. Princeton: Educational Testing Service, 1975.

Rosenshine, B. Teacher behaviors and student achievement. Windsor, Berks England: National Foundation for Educational Research in England and Wales, 1971.

Rosenshine, B. Review of teaching variables and student achievement. Conference on Research on Teacher Effects: An Examination by Policy-Makers and Researchers, The University of Texas at Austin, November 3-5, 1975.

Shavelson, R. & Atwood, N. Generalizability of measures of teacher process. In G. Borich, The appraisal of teaching: Concepts and process. Reading, Mass.: Addison-Wesley, 1977.

Soar, R. An interpretive approach to classroom learning. Philadelphia: Temple University, 1966.

Soar, R., & Soar, R. An empirical analysis of selected Follow-Through programs: An example of a process approach to evaluation. In I. Gordon (Ed.), Early childhood education. Chicago: National Society for the Study of Education, 1972.

Stallings, J., & Kaskowitz, D. Follow-Through classroom observation evaluation, 1972-1973. Menlo Park, California: Stanford Research Institute, 1974.